Addressing Gender Issues to enhance adoption of the innovative solar powered milk cooling solution for the higher efficiency of the dairy subsector in Tunisia

By

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Summary

In the spring of 2016 the project "**Field testing of an innovative solar powered milk cooling solution for the higher efficiency of the dairy subsector in Tunisia"** had started in the governorate of Sidi Bouzid. The project was implanted in two small communities located in the Delegation of Rgueb: Zitouna, and Hania. Overall, seven households were designed to use this innovative technology for one and a half year, in which the HH experienced a change in their lifestyle.

During this period of time, the target farmers had multiple visits from different teams to follow the project progress, and to observe the household adaptation to this innovative technology. Every Household experienced at least three types of interviews aiming to know the initial status of each one of them. Then, field surveys, focus group discussions (FGDs), key informants interview (KIIs) were conducted with the objective to document the gender context in the target areas and identify changes within the targeted households, especially the ones related to gender issues.

The result show that the implementation of this innovative technology in the targeted HH at first created a kind of anarchy in the usual roles of women and men. In fact both men and women had found that the introduction of this technology did more harm than good, because the milking activities takes a lot more time than usual with the implication of the two partners. Some men felt joblessness in the first few days, when women had to take more time in the activity that they are responsible for.

After a few technical adjustments on the technology, insolated cans, the impact of the experiment in the specific gender roles within the household had become clearer. A new division of role has immerged, the men and the spouses created a "role sharing" in order to achieve the milking activity. Therefore, women had more free time that they can invest in any other economic and productive activities. In the process, men tend to regain full control over the milk activity since they are convinced that this new technology will improve milk quality and thus generate more income. In the opposite side, the wives are more aware of their real potential and they reached a higher level of self-esteem since they succeeded to master the new technology and now they can use it without the supervision of men.

In a relatively short time, the solar powered milk cooling system created a new dynamic within every targeted household, creating a new vision for both men and women. The wives are thinking to use this momentum to use their potential and expand their access to and control over the productive assets of the dairying farm. The HH heads aspire to create primary milk cooperative in a clear attempt to replace the collection centers and if not at least profit from the cooling premium given by the government.

Key Words: *Sidi Bouzid, Milk, solar powered Milk Cooling solution, Gender issues*

1. Introduction

Approximately 45% of the world population depends on agriculture, forestry, fishing and hunting for subsistence and around the world; women constitute 43% of the agricultural labor force that produces much of the world's food crops. Around the world, women face constraints that prevent them from fully contributing in agricultural production and take full advantage of new opportunities created by the changes in the rural economy[1].

Tunisia is no exception for this general status of women. In 2012, rural women are 35% of Tunisian female population[2]. They are present and active throughout the agricultural production chain: in field work, livestock management, processing and conservation of products for home consumption or market…etc. Traditionally, plowing, pruning trees and sowing are reserved for men, but they participate in those activities too. Besides, women are involved in the preservation of crops, the olive harvest, planting legumes, harvest of vegetable crops, and grazing (small ruminants)[3].

In fact, rural women in Tunisia have always actively participated in agriculture; working in fields, with livestock on the farm, processing and storing products for the household and the market. In 2010, women comprised 26 % of the Tunisian labor force; quarter of the economically-active women was working in agriculture. Indeed, the real contribution of women to the agricultural sector would be significantly higher if the unpaid family labor would be reflected. The fact that women work primarily as unpaid family labor, their quantitative and qualitative contribution to agriculture has not been counted, or has been greatly underestimated, in statistics[4].

The division of labor differs according to farming systems, local tradition and age. In areas where men are engaged in fishing, mining and commerce, or have migrated to urban areas or abroad for jobs, women take all farming tasks on essentially. Otherwise, in areas where agriculture is the main source of income, the entire family is engaged in farming with the following division of labor: men are responsible for land preparation, irrigation, harvesting and livestock herding; women are responsible for hoeing and weeding, managing livestock within the household enclosure, processing and storing agricultural products. In addition of taking care of the artisanal production for both home and market: carpets, blankets, baskets and other handicrafts. Women are responsible for all household tasks, including collection of water and heating wood, used by almost 20 % of households for cooking[5].

The importance of female presence (Women & Girls) in Tunisian agricultural through all the links of the production chain is undeniable. Women have a great yet an invisible impact from production to marketing level due essentially to a Patriarchal Society. Since the late 90's Gender ***Equality & Equity*** has become a major key value that all the national and international institutes which are working to develop it using different approaches and having on sight one great goal: ***Gender equality in laws and reality***. In this context, the **G.I.Z.** funded the project **"Field testing of an innovative solar powered milk cooling solution for the higher efficiency of the dairy subsector in Tunisia"** through **ICARDA (**International Center for Agricultural Research in the Dry Areas)in association with, **INRAT** (The

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[5] Augustin E., and *al*., 2012. Women Empowerment for Improved Research in Agricultural Development, Innovation and Knowledge Transfer in the West Asia/ North Africa Region. Published by AARINENA

National Institute of Agronomic researches of Tunis), **OEP**(Office of Livestock and Pasture)**The University of Hohenheim**, **Pheasun**, **Délice Group,** In addition of other national institutions.

The experiment has started in April 2016, with 10 solar systems in 7 different farms in Sidi Bouzid region ***(Tunisia Center-west),***more precisely in two communities: ***Zitouna*** (7 farmers) and ***Hania*** (2 farmers). This innovative technology implanted in these rural communities did not only affect the milk production (Physico-chemical and bacteriological characteristics), but it affected all the household (HH) dynamics. The use of this new technology succeeded to create a new division in roles between the HH heads and their partners. Men have become more involved in the livestock activities (dairy production), women started to be interested in the adoption of new technology which will help them eventually to be more empowered. From its beginning the project has predicted these changes within the HH. So all the different partners: national and international focused on getting all the information in relation with gender using different approaches: field surveys, focus groups, key informant interviews etc. All the data collected are assembled in this final report which aims to clarify all the changes that happened in this past two years and put forward potential gendered indicators for similar interventions in the future.

2. Objectives of the study

The objectives of the rapid gender assessment in the Sidi Bouzid project target site was to understand the specific gender contexts and identify key gender issues that could help to develop gender indicators for the project against which project performance on gender related outcomes is monitored. Moreover, it could help project stakeholders and partners to develop and implement gender strategic interventions for better adoption of solar powered milk cooling innovations being tested.

3. Methodology

The study followed a qualitative case study approach as suggested by Yin (2003) in order to collect information on gender relations and the management of dairy and dairy products using participatory tools such as daily activity profile, access and control profile and etc. This technique allowed us an in-depth exploration of how socially defined gender relations are linked to the choices and management of dairy and dairy products. Moreover, it allowed exploring the different views and experiences of men and women regarding any newly introduced technologies (Sally and Fonow 2012). For this purpose, a mix of qualitative data collection methods was used such as focus group discussions (FGDs), key informants interview (KIIs), participant observation, and a reflection meeting with community. The use of such a mixed methods helped to cross-check and triangulate the information collected which in turn helps to enhance the validity and reliability of the results (Yin 2003). The collected data were analyzed using qualitative content analysis techniques as suggested by Berg (2009).

The field work was conducted by INRAT using focus group discussions (FGDs) with men, women, and youth groups consisting of 7 HH heads, 5 spouses and 5 youths in February 2016 (Baseline Survey), Field Visit in September 2016, second round of focus group discussions with men, women and youth in February 2017, and individual key informant interview with men and women in November 2017. The participants on the FGDs were identified on the bases of certain criteria such as participation in

the project, sex, age etc. so that they represent milk producing farmers in the target communities of the project on **"Field testing of an innovative solar powered milk cooling solution for the higher efficiency of the dairy subsector in Tunisia**". Moreover, key informant interviews (KIIs) was conducted with selected milk collectors, collecting centers and milk plant to extract information on gender relations, compositions, constraints and opportunities in milk value chain related to gender.

In addition to observation, a total of 3 FGDs and 45KIIs was conducted to generate information on various gender issues related to the ***Milk Value Chain*** such as gender roles, access to and control over of productive resources, decisions making, participation in milk marketing, gender based constraints and opportunities (*Table 1*).

Table1.Individualsconsulted for the study

Governorate	*Milk value chain stage*								
	Farm level *(FGDs)*			***Milk Collectors****(KIIs)*		***Collecting Centres****(KIIs)*		***Milk Plant****(KIIs)*	
	Men	*Women*	*Youth*	*Male*	*Female*	*Male*	*Female*	*Men*	*Female*
SidiBouzid	7	5	5	30	0	11	3	1	0

The results of the study is presented as follow. The first section of the result describes the general gender context in the study areas including key gender issues such as gender roles, access to and control over of productive resources, and decision making at HH level on dairy related resources. The second section covers gender based constraints and opportunities with respect to the milk value chain in the project target areas. The third section of the report presents the gendered outcome of the project at breeders' level and beyond. Finally by proposing potential gendered indicators for the project and similar interventions in the study areas, the report concludes by suggesting implications for similar interventions.

4. Results

4.1 Gender Contexts in the Project Site

As is the case in all rural communities, women suffer from gender inequality in all its possible aspects: Social, religious, financial… etc. They don't have the right to own any asset without the approval of the HH head who will have the upper hand anyway. In addition, the access to productive resources occurs through the mediation of men. Female members (Spouses/ daughters/ stepdaughters…) see their decision-making capabilities concerning resource use and output choices severely restricted by a dominant male presence. The direct result of this confusing status (*i.e* women do almost everything but do not have the right to control anything) is the setup of a total inequality situation in both roles and responsibilities between men and women.

4.1.1 Gender roles in Dairy in the project area

Women are the main actor concerning dairy production, although, they do not own either the livestock or any other assets related to milk production. Women, men, youth, and even the children in the study area (Zitouna, Hania) contribute in different ways in the production, processing, and marketing of milk (*Table 2*).The management of the dairy cows is essentially the women's duty due to their deep know-how, but men can intervene if it is necessary or in the case of women's unavailability. The youngsters are also part of this activity especially the girls who have the duty of assisting their mothers in all the HH tasks. What is cleared observed within the HH is that there is a hierarchy within the household: the HH head is on its top, followed by his spouse, then the youth and the children according to their gender and age.

The gender role exercises with the participants on the FGDs have clearly shown that there is a specific gender role in dairy production in the target project sites. Concerning some traditional activities, women are responsible for the entire management of the dairy animals and the processing dairy products at home for making some ancestral beverage such as Rayeb & Lben with the help of their oldest daughters. Men in the other hand must take care of slaughtering animals in some religious fests like Aid El Kebir or Ramadhan. However, roles such as breeding and fodder production are shared between the adults: men and women. Moreover, the youth (male and female) participate in much of the dairy activities as supporters to their family according to their availability (week-ends, holydays, and off-work days). In the case of marketing milk or dairy animals, and we mean by marketing selling these items, the HH head is the only person responsible of selling dairy animals in the local and regional markets, when women are the one who are responsible of delivering the milk to the collectors twice a day.

All the revenue resulting from the dairy production is under the control of the HH head who is the only household member able to spend without permission; on the other side all the family members including the spouse must have his approval before spending any amount of income.

Table 2. Gender roles in the milk value chain in Sidi Bouzid (Breeder's level)

Dairy& livestock Activities	*Household Member*				*Remark(s)*
	Men	***Women***	***Youth (male & Female)***	***Children (Under 16 Y.O.)***	
Management: Dairy animals					
Milking	X(*)	X X X(***)	X		Almost all the activities related to livestock are under women's domain. But in some few cases men are directly involved with different levels of involvement.
Breeding	X XX	X XX	X		
Rearing	X	X XX	X		
Housing	X	X XX	X X(**)		
Hygiene	X	X XX	X		
Grazing, tethering		X	X		
Fodder production	X	X			
Fodder collection	X XX	X XX			
Collecting dung		X XX	X		
Watering	X	X X	X XX	X X	Because it's a very easy activity, watering the cows is a youth and children's task
Processing of Milk: Making butter/Rayeb/Lben		X XX	X		In the case of milk processing, the spouses and the girls are the ones doing this type of activity especially in the season of high lactation.
Slaughtering	XXX		X		Slaughtering animals is traditionally and religiously a male's duty, especially in the religious fests such as "Al Aid El Kebir/ Ramadhan".
Marketing: Dairy products& animals					
• Animals	XXX		X		Only men and in some cases the oldest son are eligible to buy/sell animals in the local and regional market places.
• Milk	X	XXX	X		Preparing the milk cans for the collectors is women's duty in general.
Management of Income from dairy & Re-investment					
• Management of income from dairy	XXX	X			Any income from dairy is always under the men's control. Women can spend some money but only with the consent of their husband (head of HH).
• Re-investment of income from dairy	XXX	X			

Note: (*) Lowest degree of involvement; (**) Average degree of involvement; (***) Highest degree of involvement

4.1.2 Access to and control over of dairy related productive resources

The multiple field surveys conducted in Sidi Bouzid in general and in Zitouna & Hania specifically show clearly that almost all the family assets are owned by men *i.e* the household head, and in some cases women and youth could have the right to own some assets. The dairy productive resources are not an exception to this rule. In fact, the livestock, the buildings, and the means of transportation are the property of the HH head. But a closer look we will reveal that the livestock is in reality a common property of the whole family due to the important interventions of each member in this activity. A more in-depth discussion with the HH heads and their wives inevitably leads us to the truth hidden by

social taboos which is a joint property between husband and wife. Men have to show a specific form of control to external household members to ensure a certain social status.

Women and men have both an equal access to all the dairy productive resources, except the transportation assets (cars and pick-ups). But the control of these latter is under the control of the HH head but it is not a total control since women also have their word to say especially concerning the livestock. If the man wants to buy or sell any type of dairy animal he has to have the spouse approval since she is the one handling this activity day and night.

Women usually have a great sense of innovation in the rural areas, which was proven by some previous experiences such us the introduction of milking machines in the early 2000s a technology that helped women to reduce the milking time and to improve the milk production. The introduction of solar technology is no exception, thus all the women had an easy access to the technology, but only 40% of them were controlling it without the men's assistance because of a common stereotype insinuating that women's inadequate education and timidity makes them unable to control modern technology, which is a completely wrong statement because it is women who have found some secondary applications to the cooling units (freezer), and linking lamps directly to illuminate the barns at dark, in two separate regions without the least type of communication between them, then men followed the momentum and suggested the use of solar energy for milking machines.

In overall, men and women do have the same degree of access to all productive resources. But women are not allowed to take full control of these resources due to social and religious constraints.

Table 3. Access to and control over of dairy related productive resources in Sidi Bouzid by gender

Dairy related Productive resources	*Access*		*Control*		*Remark*
	Men	***Women***	***Men***	***Women***	
Milking cow	XXX	XXX	XXX	XX	Mostly shared access & joint decision is exercised.
Heifers/ bulls/ calves	XXX	XXX	XXX	XX	Mostly shared access & joint decision is exercised.
Milk	XXX	XXX	XXX	XXX	Women have equal access & control over of milk unlike the other resources.
Milk cans	XXX	XXX	XXX	XX	Mostly shared access & joint decision is exercised.
Milking machine	XXX	XXX	XXX	XX	Mostly shared access & joint decision is exercised.
Transportation facility (such as Pick-up car etc.)	XXX	-	XXX	-	Entirely controlled by head of the HH.
Livestock sheds/Barns	XXX	XXX	XXX	XX	Mostly shared access & joint decision is exercised.
Water pump	XXX	XXX	XXX	XX	Mostly shared access & joint decision is exercised.
Solar powered system technology	XXX	XX	XXX	X	Decision power regarding the technology belongs to men.

Note: Number of "X" denotes level of power relations between spouses.

4.1.3 Decision making on dairy related resources

Rural communities are patriarchal; the HH head controls almost all the available resources. Men are also the main responsible of taking all crucial decisions with the consent of all the family members including the spouses, and it is meant by consent that they are informed of the decision after it has been taken. In some cases, the spouse is the main responsible of taking decision, generally in the absence of the HH head or in the case of a widow (making her the HH head).

Firstly, women do not have much to say in the financial decisions because all the financial resources of the HH are under men's control, but they do take care of the day-to-day decisions, their opinions are consultative and advisory. But in some cases, women have the upper hand; they are the responsible of choosing the milk collector according to his profile; meaning women trend to choose a collector who has the least rejection rates of the region. The spouses are responsible of maximizing the milk revenue which will ensure to her a bigger share in the HH income. Women also designate the animals to be sold and bought, because they manage the livestock activity (Table 4).

Secondly, men are the one who decides if a new technology should be adopted or not, and after taking the decision they generally inform all the HH members. Yet, this attitude could change depending on the spouse profile. In fact, the discussions conducted with the spouses 'shows that the ones under the age of 35 years are more involved in taking decision because of their high educational level which is a missing criteria in the case of the spouses exceeding 35 years.

Table 4. Participation in decision making in dairy related productive resources in Sidi Bouzid by gender

Key dairy related activities	*Decision Making*		*Remark*
	Men	***Women***	
Milking cow management	XXX	XXX	Women are the one responsible for managing the dairy cows, and thus they have equal stake in decision making regarding the animal.
Marketing of dairy animals	XXX	XX	Men are responsible of taking the dairy animals to the markets but the spouse is the one who have to identify the targeted animals because she's the one responsible for managing the animal.
Milk and milk products	XXX	XXX	Men and women have the same degree of decision making over the milk and its by-products.
Milk equipments such as cans	XXX	X	Since men own all the productive assets, they decide if the HH should buy/sell or transfer any equipment related to dairy production.
Milking machine	XXX	X	
Marketing of milk	XXX	XXX	Wife and husband decide together the marketing strategy but often women are responsible for its sale.
Adoption of new technologies	XXX	X	The HH head is the one who decides if any new technology should be adopted.
Input marketing such as feeds, drugs etc.	XXX	X	Men takes the decision about buying any inputs, but women also take part in identifying them and managing the stocks

Note: Number of "X" denotes level of participation in decision making.

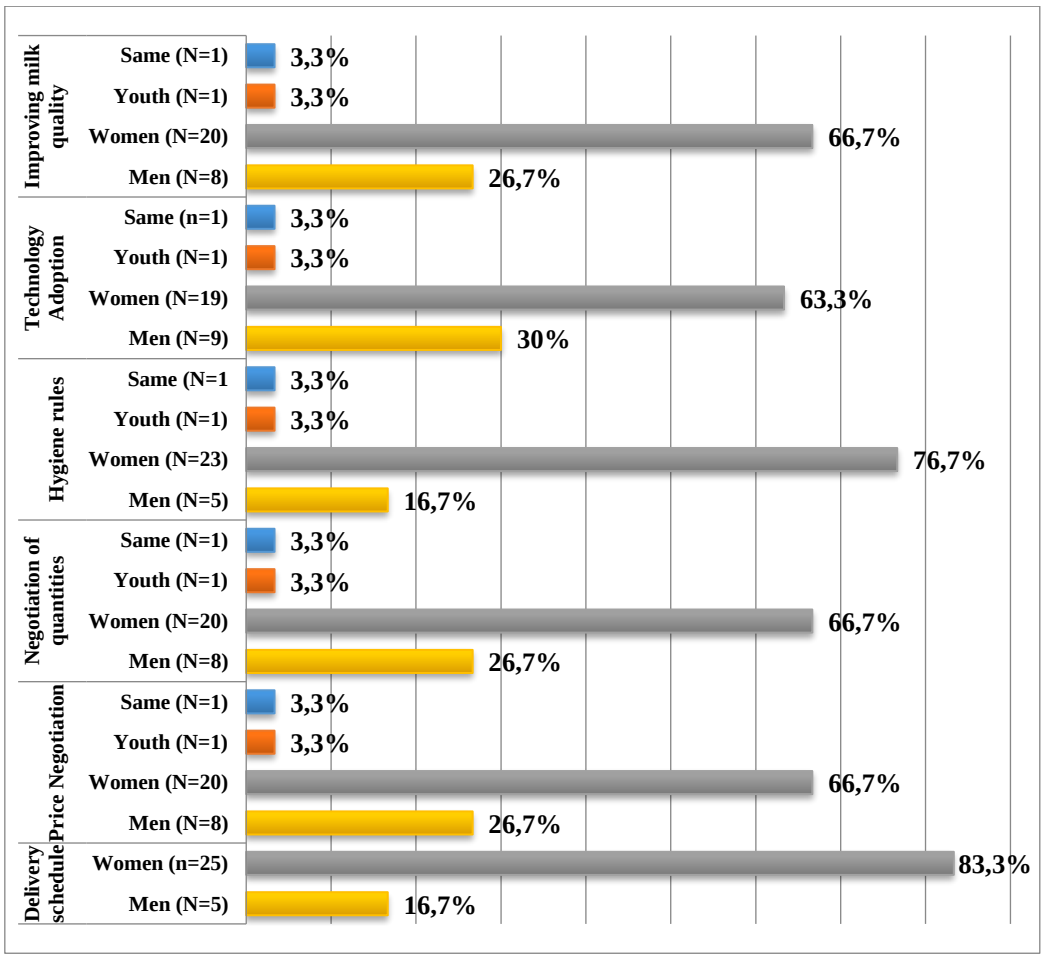
Finally, only men decide about the inputs marketing because they are the only ones who have access to the markets. Moreover, they have better access to the necessary information about the quality and the prices of every type of inputs needed than their spouses.

4.1.4 Gender Relations between Producers and Collectors

Gender affects all links in the milk value chain. In fact, women are the producers of milk besides being the managers of dairy cows and the responsible of selling milk to the collectors.

The results from the surveys done with the milk collectors shows clearly that they prefer to deal with women rather than men. Women are more accurate in their delivery schedule which is crucial for milk collectors since every minute won ensures a better milk quality at the delivery. Also women have a better know-how in livestock management than men; respect the hygiene rules, and they always tend to improve milk quality. The collectors also witnessed that women are more innovative than men; they are always seeking new information and innovative technologies granting a better milk quality although they are not the one who make decisions regarding its adoption in male headed households. Moreover, the female breeders have a better sense of negotiation concerning prices and quantities (Figure 1).

Figure 1. Collectors' preferences by gender



(***Source:*** *Field survey with collectors)*

At the collecting centres level, women are the main workforces in addition of occupying important position: manager, engineer/technician responsible for quality control, and accounting officer. They constitute the majority of the workforce (81%) responsible for milk reception, and cleaning the centres' equipments as observed in all collecting centres. But If they hold a more important position such as engineer, technicians, or manager their task is more important since it is them whoare responsible of accepting or refusing the milk from the collectors, and it's never easy since all their vis-a-vis are men who fiercely defend their interests. But the collectors don't see any difference between dealing with a male or a female manager (Table 5).

Table 5. Human resources at the collecting centres by gender

	Men		Women	
Qualification	**Number**	**%**	**Number**	**%**
Engineers	3	4%	2	3%
Technicians	12	**17%**	3	4%
Master degrees	11	**15%**	7	10%
Worker	21	30%	54	**81%**
Driver	24	34%	1	1%
Total	71	100%	67	100%

*(**Source:** Field survey with collection centres)*

4.2 Gender Based Opportunities and Constraints to the Adoption of Solar Powered Milk Cooling Innovation

4.2.1 *Gender Based Constraints (GBCs)*

All along the project and at each survey made we have encountered a number of gender based constraints. At the beginning of the project inception and implementation phase, the project staffs were gender blind. In fact, the women were excluded from the start, only men were consulted about the dairy production issues in the chosen area, although, women are the key players in dairy and livestock production since they are responsible of managing the livestock. The best approach would have been to involve couples in the consultation process (using separate men and women groups) and implementation phases.

The second constraint is purely social; since in the Arab-Muslim society in general and in the rural communities specifically women have developed a false image of themselves insinuating that they are at the service of their husbands and families and it is their purpose of life. This ended up creating an illusion that women are not equal to men but in the best case scenario they are only men's compliment. This shell was partially broken by women adhering to the project because it was they who proposed new ideas such us secondary use for the freezer and the use of the solar panels to illuminate the barns by linking lamps as observed during the assessment study. Also women have a low level of education which feeds their feelings of inferiority more deeply to men who are relatively the most educated. And this is why women at the beginning of the experience needed the help of men to control the system which will lead eventually to a partial changing of gender roles.

The third constraint is a direct result of the powerlessness of women, and their lack of agency. All women's contributions at all production levels are invisible because men give themselves all the honours of the introduction of this new technology. But the essential cause is the gender blindness of

the project team who tend to have only the men's perception, and it is also because of the reason that project teams are often composed of male staff members.

Women also suffer from gender-based discrimination in wages at both collecting centres and dairy plant. This inequality affects women workers and managers reinforcing the existing women's feelings of inferiority towards men (Table 6).

Table 6. Gender based constraints to women's participation in the project in the target areas

Gender Based Constraints	*Consequences*	*Causes/Factors leading to GBCs*	*Potential Actions to address GBCs*
Gender blindness at beginning	Exclusion of women	Low gender capacity of project initiators/implementers	Develop gender capacity of stakeholders involved in the dairy value chain
Low women's self-esteem	Limited participation of women	Existing gender norms/cultures/ religion undermines women self esteem Men tend to use religious laws to have upper hand over women	Develop women's agency through training, exposures, consultations Give them equal opportunities Ensure projects consult women at the beginning & through-out
Lack of agency	Low women's self-esteem	Rural women are less educated	Facilitate adult literacy for women Enhance their participation & exposure
Women's limited access to & control over/ownership of dairy resources, technologies & benefits	Limited participation Gender stereotype perception about women	Women lack agency, have low self-esteem and usually development projects are gender blind.	Develop gender capacity of stakeholders Gender sensitization works for men & women
Gender stereotypes of women farmers	Lack of self-awareness Surrender oneself to the needs of others Powerlessness	Constraining gender norms/cultures Inappropriate social & religious habits	Improve women's agency (e.g. hard skills & soft skills) Create opportunities for women Implement gender mainstreaming strategies
Women's work/contribution to the milk VC is invisible	Projects fail to achieve its full impact Women's benefits from project interventions would be realized. The project would lose women's new skills & knowledge	Traditionally women's work are not equally valued The social context does not allow free conversation between sexes Often project staff are mostly men Mostly project did not conduct gender studies, gender sensitization activities at the beginning	Ensure projects conduct gender studies and gender sensitization activities at the beginning
Gender inequality in terms of salary earnings at collection centres	Keep women in low self-esteem positions Limit women's benefits from their work	Private sectors tendenciesto exploit one's weakness/inabilities of young graduated women Women's lack of opportunities	Create awareness about gender equality and justice Ensure the execution of labour laws at all levels

*(**Source:** FGDs & KIIs with breeders, collectors & collection centres)*

4.2.2 *Gender* Based opportunities

In spite of all the gender based constraints, there are some great gendered opportunities for both women and men affecting all the domains: social, economic, and cultural. This will provide a better opportunity for greater impact of the project if taken in to considerations for similar interventions in the future by stakeholders such as private sector, the governmental institutions, and the NGO's.

The first obvious opportunity is that women are already actively involved in dairying activities and the increase of women's access to and control over the dairy production assets, thereby increasing herself-esteem. So she could help the HH head in taking crucial decisions beneficial to the whole family. This could be done by taking the following steps:

- ✓ Work with local partners (OEP/CRDA /AVFA...) to facilitate women's access to extension advice, credit and inputs, especially for livestock enterprises that are mainly women's domain.
- ✓ Participating women in a process of transfer and adoption of new technologies for the rest of the project area through farmer to farmer linkages (Zitouna & Hania)
- ✓ Launch a campaign/gender sensitization sessions targeting household heads ensuring a fair use of HH income for all family members especially the spouses to empower women economically and socially (public speaking).

The second opportunity is the creation of a female association aiming to setting-up women's self-help groups which likely increase their chances of access to:

- ✓ Credit: funding a small business company evolving in their areas of expertise such as dairy and local products: handicrafts.
- ✓ Trainings: to develop their skills in domains such as; leadership, confidence building, saving money, managing, and negotiation skills.
- ✓ Support functional adult literacy classes.

In the other side, men have to benefit from a same program but more suited to their conditions: following a training program targeting their communication skills with women, and the importance of gender equity/equality and its benefits for the HH and the rural communities.

4.3 Gendered Outcomes of the Project

4.3.1 At Breeders/farm (HH) level

Farmer's perception about the technology

The solar powered milk cooling solution put in place is perceived differently by each member of the household. The HH head has all the required information about the experiment because he is the one, who was frequently contacted, consulted and has been all long the process of implementation and the main reason of its existence. The spouse and the children have different understanding about the technology and have their own perception. This could be an indication that they were not engaged in the experiment as much as the HH head.

The women think that this technology is a governmental program for the small-holders whose main objective is to reduce milk rejection in the region of Sidi Bouzid. This experiment is on trial in just few HH then it will be out scaled in the entire region once proven successful. And it has two major impacts from the women's point of view. The first one is that the milk has a better quality after the use of the insolated cans especially in the summer season. The second impact is the men's involvement in the milking activity is growing bigger. This is due to the fact that the first milk cans introduced were heavy

and thus women cannot handle them by their own. The other reason is the control panels which women did not know how to use them at the beginning, because only men have had training on how to use them. In the long run, this new technology did create a partial changing role in the milking activity since men's involvement had became more important which led to equitable labor sharing reducing the stress/burden on women. The work load is more important for women as they mention it often times (example see Table7)

Table 7. Gendered perception about the Solar powered milk cooling technology innovation

Parameters of interest	***Men (Household Head)***	***Women (Spouses)***	***Children***
Description of the technology	It's a group of solar panels connected to cooling units that produce ice cubes to cool the milk during its journey to the collecting center.	It is a fridge that makes ice cubes to cool the milk after milking it to reduce the losses especially in the summer season.	The idea is to cool the milk using solar energy.
Date of its introduction	2016	2016	2016/2017
By whom / what	OEP/ICARDA/GIZ...	The government.	Do not know exactly.
How was it introduced or adapted?	Chosen from a group of breeders in the region who have the best milk production characteristics	Do not know it just happened.	Do not know.
Who made the decision to adopt the technology	The household head (myself).	The household head (my husband).	The household head (my father)
Who uses the technology and who controls its' use	All family members who knows its functioning	My husband and I, and sometimes the children if they are available.	My parents in general.
Who benefits from the new technology	No clear benefit so far but expect the whole family to benefit from it if we organize ourselves in to milk cooperatives.	There is no benefit yet since price of milk is the same before and after the project, only hard times every morning.	Do not know.
The impact on agricultural production	No changes since the experience is conducted on small level.	Milking the cows takes twice longer than usual.	Do not know.
The impact on intra-household division of labor (gender roles)	The man has to be involved in the milking procedure because of its delicacy.	The man is back in the milking activity.	Everything mixed up between the parents; the available person do the job.
Impact on milk quality	Milk rejection reduced, milk is better when cooled and improved its quality.	Milk rejection reduced, milk is better when cooled and improved its quality.	Milk rejection reduced, milk is better when cooled and improved its quality.
The impact on the livelihoods, food security and well-being in the community	Not yet.	Not Yet.	Not Yet
Estimate the number of households in the community using the technology	Five persons including me.	Five persons including me.	Do not know.
Discuss why other households in the community do not use the technology.	Because they were not chosen to be part of this experience.	Do not know.	Do not know.
Have any technologies or practices been introduced but failed	No	No	No

The perception of youth is unique; they do have a short and accurate description of the system without having the opportunity to use it in most cases except the two chosen in Hania. They just observe, and

they do ignore a lot of information about the system such as who is responsible of its introduction and his/its "real purpose".

Impact on Gender Relations at HH level

The introduction of the milk cooling system did initiate a gender changing roles in the HH in general, and specifically in the milking activities. In fact, before the introduction of this technology; women were doing almost everything from housekeeping to livestock and crop production. Men in the other side were responsible of ensuring off-farming income, and all the necessary outputs for both house and farm.

After the introduction of the system and when farmers get used to it, we observed a gender changing roles particularly in the milking activities since the system has an immediate impact on it (table 8).Men have become more involved in the breeding activities due to the nature of the new technology which demands more knowledge and physical strength, because women haven't had any training about the system and its requirements. It should be highlighted that women expressed a contradiction in their perception of the time needed to milk cows. At the first months of the project, women felt more stress because of the scientific requirements of the experiment: they have to do the job twice *i.e.* prepare the conventional cans and the insolated ones. But since the coming of the new cans significantly lighter than their predecessors, women felt less stress than the beginning of the experience which created more spared time in their daily time budget. The men expressed the same stress in the beginning of the project because they had the duty of supervising both the system and their wives whenever the cows were milked. Some of them confirmed that they had lost more than ten days of work in the first days of the experience; others had to change their daily habits and adapt it to the new circumstances.

After sometimes in the course of projects' implementation phase, a new dynamic emerged in terms of HH's time and labor allocation. The main strategy is that the men and women will take care of the tasks that they master the most. In the case of milking the cows, the woman will milk the cows but in the same time the man has to get the insolated cans ready to be used. After that, the man will take care of putting the cans in the usual place for the collectors, and then go to their work. At the same time, women will clean the milking equipment and the sheds. This changes did save more time for women for other activities, women claim to invest this spared time in watching TV which was almost impossible to do before men's intervention. Men did express some changes; they are more and more interested in the dairying activities which were a field dedicated to women. The main reason is the use of this milk cooling technology will surely generate more income for the HH, although, both men and women said that they did not see this yet. However, it is clear that men will instinctively take control over it (table 8).

Table 8. Observed changes within the HH as a result of the project

Dairy Activities/ items	*Before the intervention*	*After the intervention*	*Notes*
Handling of Milking equipments (Cans, machine …)	Only Women	Mainly men	Example is the case of milk cans. In the beginning, the introduced milk cans are relatively too heavy for women to operate with it and thus men's involvement became indispensable although traditionally this is not regarded as men's role.
Breeding activities	Mostly women	Mostly men	This could be partly as a result of the fact that when a value of certain product is improved men tend to involve more and take over the control of the benefit which is traditionally under women's control. This implies the importance of gender sensitization work on men and

			improving of women's agency through trainings, exposure etc.
HH Labor allocation onmilking activities & its management	Only women	Shared	The new milk canes (*i.e* the second version) helped women's to save time and reduce stress and rearrange daily routine as men became involved in milking activities, handling the machines & etc.
Household energy	Not from solar energy	Generated from solar energy	Women are responsible for HH energy supply. The solar powered systems are generating an alternative HH energy which saves the women some money which she could invest on productive activities (such as buying HH staffs, children schooling ... etc.).

Impact on Women's Access to and Control over of Resources and Decision Making

The project had not enough time to improve the self-awareness and self-esteem of the spouses so they can benefit from a better access to and control over the productive resources of the household. Yet, we observed that the women now are able to manage the solar system without the assistance of men and they expressed their will to continue using it and share the benefit from the dairying activities. However, this has to be complemented with gender sensitization activities to ensure women's equitable control over parts of the benefits. This is because of the fact that as the market values of certain product, traditionally under women's control, increases men tend to control it.

Relatively speaking, women have some level of decision making before the introduction of the new technology on dairy products. But now the spouses are aware of the importance of their decision within the HH since almost all the innovations made in the system were their suggestions but it was done through men since the project staff always consult the HH head. And thus, spouses were consulted equally with their male spouses, they would have developed much confidence and self-esteem for better negotiations that would helped them achieve greater empowerment.

4.3.2 Impact on gender relations beyond the farm level in the Milk Value Chain

The small scale of the experience and the short period of time in which the project took place, impacted only the gender relations between breeders and collectors. And since the two collectors responsible of the milk transportation are also members of the experiment the impact on them won't be the same as on non-members of the experiment *i.e.* they are totally convinced of the technology's benefits. But from a gender point of view, the relation between breeders and collectors changed a little bit because the collectors now are dealing sometimes with the HH head, other times with the spouses. And we do know that the transporters prefer to deal with women for various reasons such as their punctuality on delivery, quality performance and etc.

At the moment, although, the project did not have any impact on the gendered composition of milk collectors, staff of collection centers, and dairy plant, it is expected to impact at some level in the long run as the innovation will continue to progress in the region.

4 Possible Gendered Indicators for the Project on Solar Powered Milk Cooling Solution

The surveys, focus group discussions (FGDs), and key informant interviews (KIIs) conducted combined with personal observations allowed us to identify potential gendered indicators.

In spite of its relatively short duration, the project has several impacts within the household. The introduction of the on-farm cooling system created a new dynamic and we observed a partial changing of roles between men and women. The men are now helping their spouses in milking the cows, and delivering the milk to the collectors. As a result of this intervention women succeeded to create a new daily routine in which they have free time, something considered impossible before men's intervention. This free time now is used essentially on entertainment activities, mainly watching TV. Moreover, they could invest the extra time on other economic activities ensuring a better access to and control over the productive resources of the HH.

Women are considering the creation of an association whose main objective is to create new opportunities for women in the region; their strategy is to have access to the market and use the legal status of the organization to open up new economic opportunities. This opportunity will create a new source of income to the HH that can be invested in their children's education and improve household's standard of living.

Table 9. Potential gendered indicators for the Project on Solar Powered Milk Cooling Solution

Gendered indicators	*Objectives*	*Reasons*	*Methods (Means of capturing the data)*	*Tools*
Impact on Gender Roles at HH level	- To establish gender roles in milk value chains - To capture changes in the gender roles as a result of the project	- It is observed that the project had impact on the HH's labour allocation: men take over part of the milk handling works which are traditionally under women's role.	- Focus Group Discussions (FGD) with men, women, & youth groups separately followed by joint feedback sessions.	- Harvard Analytical Framework - Activity profile tool - Observation
Impact on Access to & control over of productive resources	- To identify available & access to productive resources necessary for a HH to engage in dairy production and other available economic opportunities - To investigate the impact of women's access to productive resources on HH members (eg. Children's schooling, HH's nutrition & etc.)	- The project saved time to women which could be used for other economic activities as a result of men's sharing of roles. It also could open up other economic opportunities for women and youth as a result of their engagement in the project. - As a results of expanded women's economic opportunities, positive impact on HH's welfare could be realized including better access to nutrition, children schooling and etc.	- Carry out separate FGDs to identify list of possible economic activities available to men, women & youth then using the information design questionnaire conduct individual interview to establish baseline gendered indicators	- Harvard Analytical Framework: access and control profile - Frame work for Gender analysis & Action Planning
Impact on Participation in Decision Making related to dairy activities	- To identify the level of women's involvement in decision making over productive resources at their disposal and created by the project/innovation	- The project might affect HH power dynamics - Women's involvement in decision making on key assets the HH own &might be improved or reduced as a result of their participation in the project	- Conduct separate FGDs with men, women, and youth groups followed by detailed questionnaire for individual interview to establish baseline gendered indicators	- Harvard Analytical Framework: access and control profile tool
Impact on Gender relations beyond farm-gate (collectors & milk plant)	- To identify any possible impact (+/-) of the project on gender relations between breeders and collectors, change in gender compositions and perceptions.	- the project could have impact on the gender relations between producers and collectors - certain gender groups may control the opportunity created excluding others etc.	- Key Informant Interview (KII)	- Use of guiding questions/ Semi structured checklists
Opportunities created for men & women	- To investigate any other opportunities created for men and women.	- The project could have spill over effect in creating other economic opportunities for either sexes or certain gender groups.	- Key Informant Interview (KII)	- Use of guiding questions/ Semi structured checklists

This dynamic has to be taken up by the various national partners of the project to make use of it, and not to repeat the exclusion of women. Also the gender responsiveness of experiment equipment *i.e.* the solar panels have to be continuously checked-out by the project specialist. The farmers will have the insurance that they won't be abandoned to their fate.

5 Implications for Similar Interventions

The project eventually awoke the potential of the region in general, and that of women in particular who want more information and more interventions from different partners of the experiment. Also women's role in dairying is less visible before the implementation of the project and that was proved during the baseline survey, as a results of the participatory approaches followed for gender data collection which is known for its community empowerment, their role being more acknowledged by all the milk value chain actors than before. The project has a potential in achieving gender equitable objectives as observed within the target HHs, at least by positively impacting the existing gender relations- gender division of labor at HH level. Although, women in rural Tunisia are economically less empowered, women in the targeted HHs, in fact, do own some assets within the HH in general jointly with the head of the HH. Women in the Sidi Bouzid region have some liberties that other women in other regions do not have; they can make any urgent decisions in the absence of men without encountering any problems.

The first step is to continue the project in partnership with other Stakeholders, Institutes, and NGO's… etc. who must take advantage of the existing gendered information and continue strengthening gender equality in the two communities where awareness on gender issues are now relatively more sensitized. The project and similar interventions would benefit both men and women livestock keepers from the dairy subsector if the gender based constraints (GBCs) identified are addressed. Therefore, addressing the existing GBCs systematically through suggested strategic interventions will improve the adoption of the technology and eventually enhance the performance of the milk value chain in the region.

The second step is to take advantage of the project members' characteristics since they are the community leaders and thus can influence positively their neighborhood by hosting training programs in relation with the introduced innovation. Moreover, they can be used for sensitizing communities on gender issues which includes joint consultation and decision making on dairying within the HH which will eventually increase women's self-confidence and self-awareness.

The third and most important step is to convince men of the benefits of a women's association on milk in the region, and the importance of creating cooperatives that will facilitate marketing of milk and input supplies.

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